

Three-Dimensional Bioprinting and Its Potential in the Field of Articular Cartilage Regeneration.

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Public Summary:

Three-dimensional (3D) bioprinting techniques can be used for the fabrication of personalized, regenerative constructs for tissue repair. The current article provides insight into the potential and opportunities of 3D bioprinting for the fabrication of cartilage regenerative constructs. Although 3D printing is already used in the orthopedic clinic, the shift toward 3D bioprinting has not yet occurred. We believe that this shift will provide an important step forward in the field of cartilage regeneration. Three-dimensional bioprinting techniques allow incorporation of cells and biological cues during the manufacturing process, to generate biologically active implants. The outer shape of the construct can be personalized based on clinical images of the patient's defect. Additionally, by printing with multiple bio-inks, osteochondral or zonally organized constructs can be generated. Relevant mechanical properties can be obtained by hybrid printing with thermoplastic polymers and hydrogels, as well as by the incorporation of electrospun meshes in hydrogels. Finally, bioprinting techniques contribute to the automation of the implant production process, reducing the infection risk. To prompt the shift from nonliving implants toward living 3D bioprinted cartilage constructs in the clinic, some challenges need to be addressed. The bio-inks and required cartilage construct architecture need to be further optimized. The bio-ink and printing process need to meet the sterility requirements for implantation. Finally, standards are essential to ensure a reproducible quality of the 3D printed constructs. Once these challenges are addressed, 3D bioprinted living articular cartilage implants may find their way into daily clinical practice.

Scientific Abstract:

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